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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

APPEAL BRIEF FOR THE APPELLANTS

Ex parte MARUYAMA et al.

WAFER AND EPITAXIAL WAFER, AND MANUFACTURING PROCESSES  
THEREFOR

Serial Number: 09/856,139  
Filed: May 29, 2001  
Appeal No.:  
Group Art Unit: 2814  
Examiner: A. Mai

Submitted herewith is an Appeal Brief. A check in the amount of Five Hundred Dollars (\$500.00) is enclosed to cover the official fees for the Appeal Brief. Please charge any fee deficiencies required with respect to this paper, or overpayment to our Deposit Account No. 01-2300, **referencing docket number 107242-00017.**

Respectfully submitted,

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Date: January 4, 2005

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the Appellant:

Confirmation No.: 3293

Fumiaki MARUYAMA et al.

Group Art Unit: 2814

Application No.: 09/856,139

Examiner: A. Mai

Filed: May 29, 2001

Attorney Docket. No.: 107242-00017

For: WAFER AND EPITAXIAL WAFER, AND MANUFACTURING PROCESSES  
THEREFOR

**BRIEF ON APPEAL**

Date: January 4, 2005

I. INTRODUCTION

This is an appeal from the action of the Examiner dated June 4, 2004, finally rejecting claims 67-77, all of the non-withdrawn claims pending in this application, as being unpatentable over certain prior art under 35 U.S.C. 102 and 35 U.S.C. 103. A Notice of Appeal was timely filed on November 4, 2004, with a Petition for Extension of Time. This Brief is being timely filed.

II. REAL PARTY IN INTEREST

The real party in interest in present application on appeal is Ulvac Coating Corporation.

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### III. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences known to the Appellants, Appellants' representative or assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

### IV. STATUS OF AMENDMENTS

A Response was timely filed on September 7, 2004. Appellants' Response filed September 7, 2004, did not contain any amendments. Thus, all amendments have been entered by the Examiner for the purposes of appeal. Thus, claims 1-26 stand cancelled, claims 27-66 stand withdrawn as being directed to non-elected subject matter and claims 67-77, the remainder of the claims pending in the present application are being appealed.

### V. SUMMARY OF THE CLAIMED SUBJECT MATTER

The present invention relates to clean room air conditioning facilities comprising: an air conditioner having a boron-less filter and a boron adsorbing filter; and one or more of wafer treatment apparatuses each having a boron-less filter, wherein an atmosphere gas is recycled between the air conditioner, the clean room and the wafer treatment apparatuses, and a method of using thereof.

### VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 67 and 69 stand rejected under 35 U.S.C. 102(e) as being anticipated by Kobayashi et al. (U.S. Patent No. 5,997,598).

Claim 68 stands rejected under 35 U.S.C. 103(a) as being obvious over Kobayashi et al. in view of Johnson (U.S. Patent No. 6,102,977).

Claim 70 stands rejected under 35 U.S.C. 103(a) as being obvious over Kobayashi et al. in view of “Appellant Admitted Prior Art” (referred to hereinafter “AAPA”).

Claims 71-77 stand rejected under 35 U.S.C. 103(a) as being obvious over Kobayashi et al. in view of Mitani et al. (U.S. Patent No. 5,804,494) in view of AAPA.

## VII. ARGUMENT

### i. The Law

#### 1. The law regarding factual inquiries to determine anticipation.

In order to be anticipatory under 35 U.S.C. § 102, a prior art reference must have each and every feature set forth in the claims, Akzo N.V. v. U.S. Int’l Trade Comm’n, 808 F.2d 1471, 1 U.S.P.Q. 2d 1241 (Fed. Cir. 1986).

#### 2. The law regarding factual inquiries to determine obviousness/non-obviousness.

Several basic factual inquiries must be made to determine obviousness or non-obviousness of patent application claims under 35 U.S.C. § 103. These factual inquiries are set forth in Graham v. John Deere Co., 383 U.S. 1,17,148 U.S.P.Q. 459, 467 (1996):

Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; the level of ordinary skill in the pertinent art resolved. Against this backdrop, the obviousness or non-obviousness of the subject matter is determined.

The specific factual inquiries set forth in *Graham* have not been considered or properly applied by the Examiner formulating the rejections of claims 4 and 5. Particularly the differences between the prior art and the claims were not properly determined. As stated by the Federal Circuit in In re Ochiai, 37 U.S.P.Q. 2d 1127, 1131 (Fed. Cir. 1995):

[t]he test of obviousness *vel non* is statutory. It requires that one compare the claim's subject matter as a whole with a prior art to which the subject matter pertains. 35 U.S.C. § 103.

The inquiry is highly fact-specific by design.... When the references cited by the Examiner fail to establish a *prima facie* case of obviousness, the rejection is improper and will be overturned. In re Fine, 837 F.2d 1071, 1074, 5 U.S.P.Q. 2d 1596, 1598 (Fed. Cir. 1988). (Emphasis added.)

When rejecting claims under 35 U.S.C. § 103, an Examiner bears an initial burden of presenting a *prima facie* case of obviousness. A *prima facie* case of obviousness is established only if the teachings of the prior art would have suggested the claimed subject matter to a person of ordinary skill in the art. If an Examiner fails to establish a *prima facie* case, the rejection is improper and will be overturned. See: In re Rijckaert, 9 F.3d 1531, 28 U.S.P.Q. 2d. 1955 (Fed. Cir. 1993). “If examination.... does not produce a *prima facie* case of unpatentability, then without more the Appellant is entitled to the grant of the patent.” In re Oetiker, 977 F.2d 1443, 1445-1446 24 U.S.P.Q. 2d. 1443, 1444 (Fed. Cir. 1992).

Appellants respectfully submit that the invention defined by present claims 67 and 69 is not anticipated because no prior art reference has each and every feature set forth in these claims. Appellants further respectfully submit that the Examiner has not made proper *prima facie* rejections of claims 71-77 under 35 U.S.C. § 103(a), because the prior art references cited fail to teach or suggest each and every feature set forth in these claims.

The present claims require, inter alia, “[c]lean room air conditioning facilities comprising an air conditioner having a boron-less filter and a boron adsorbing filter; and one or more wafer treatment apparatuses **each having a boron-less filter**” (see claim 1). The atmosphere gas is recycled between the air conditioner, the clean room and the wafer treatment apparatuses.

Kobayashi et al. describe an air filter for a clean room. In their Example 3, Kobayashi et al. disclose that “the wall material, the filter material for the air filter (ULPA filter) and the sealing material for securing the filter medium and the frame of the air filter were used in the combination shown in Table 6 to fabricate each of local facilities for use in semiconductor production apparatus” (column 14, lines 55-60).

The Examiner has asserted that Kobayashi et al. teaches “...one or more of wafer treatment apparatuses (local facilities) each having a boron-less filter (ULPA filter)...”

However, Table 6 on columns 23 and 24 of the Kobayashi et al. patent makes clear that the boron content of the ULPA filter (“U.F.”) material ranges from 15 to 52  $\mu\text{g/g}$ .

As the Examiner has noted, the present specification refers to a boron-less filter as being “an air filter from which no boron is released” (see page 8, line 25 to page 9, line 1 of the present specification. The Office Action then asserts that Kobayashi et al. teaches a boron-less filter since there is no measurable boron in the local facilities described in Kobayashi et al.

However, the boron-containing filters of Kobayashi et al. are not air filters from which no boron is released. Kobayashi et al. disclose that “[a]s can be seen from the

results, in the local facilities of Nos. 31 and 33 corresponding to the embodiments of the [Kobayashi et al.] invention, analysis values for the organic phosphorus compounds and the boron compounds in the air at the inside of the local facilities are below the detection limit values, and since the organic phosphorus compounds and the boron compounds are not present in the local facilities, such local facilities are particularly suitable as the local facility for use in semiconductor production. On the contrary, the local facilities of Nos. 32 and 34 corresponding to the comparative examples of the [Kobayashi et al.] invention are not desired, since either the organic phosphorus compounds or the boron compounds are present in the air at the inside of the local facilities and there [is] a worry of causing unnecessary doping for the local facility used in the semiconductor production” (see column 15, line 10 to column 16, line 10).

In fact, the components of the boron-containing filters used in Kobayashi et al. Examples No. 31 and No. 33 appear to be the same as the components used in the boron-containing filters of Kobayashi comparative Examples No. 32 and 34, respectively. As the filters appear to be the same, and as Kobayashi et al. explain that the filters of Examples No. 32 and/or 34 release boron since boron is in the air at the inside of the local facilities, **the filters of Examples No. 31 and No. 33, being the same as filters 32 and 34, respectively, would also be expected to release boron.**

The present specification characterizes one property of a “boron-less” filter as not releasing boron. The Office Action takes the position that since the filter of Kobayashi does not release boron, the limitation of claim 67 is met. Appellants respectfully disagree that Kobayashi does not release boron.



Appellants wish to explain about a boron-less filter used in the present application (e.g., a boron free ULPA filter (Nippon Muki Co., Ltd. ATMMF-31-P-B); see page 25, the last paragraph of the present specification). As a filter medium, A PTFE (Poly Tetra Fluoro Ethylene) complex material is used for “a boron-less filter” of the present patent application. According to the test result by the manufacturer, boron is not detected from this filter medium. On the other hand, as the comparative example thereof, boron is detected from a filter medium made of glass fibers. Further, at the ultrapure water elution test of the filter medium, boron is not detected from the PTFE complex filter medium while it is detected from the glass filter medium (see the attached English translation of the pamphlet of the manufacturer).

**Thus, it is clear that the filter used in Kobayashi contains boron and releases a small amount of boron because in Kobayashi, the amount of boron content in the PTFE complex filter medium is below detection limit value (see the Examples 24 and 28 of Kobayashi) while boron is detected from the glass filter medium (see the other Examples).** Therefore, the boron-releasing filter used in Kobayashi is clearly different from the boron-less filter of the present claims.

“The boron-less filter” used in the present application does not contain boron indeed, but the boron-releasing filter used in Kobayashi is not a boron-less filter. Furthermore, in the present application, the boron concentration in the clean room is 15 ng/m<sup>3</sup> or less (e.g., see page 26 of the present specification). On the other hand, in Kobayashi, the boron concentration in the clean room is about 100 ng/m<sup>3</sup>, and therefore, the boron concentration in the clean room of Kobayashi is much higher than achieved with the present invention. Accordingly, performance of the filter used in the

present application is very different from that of the boron-releasing filter used in Kobayashi.

Accordingly, the present invention as claimed was not anticipated and would not have been obvious to a person of ordinary skill in the art at the time the invention was made in view of Kobayashi.

The asserted AAPA is applied to show that boron can attach on a surface of a silicon wafer. However, as the AAPA does not teach or suggest “one or more wafer treatment apparatuses each having a boron-less filter” as required by the present claims, the AAPA fails to make up for the deficiencies in Kobayashi et al.

Mitani et al. is applied only to show the boron concentration in a silicon wafer. As is the case for Kobayashi et al. and the AAPA, Mitani et al. does not teach or suggest “one or more wafer treatment apparatuses each having a boron-less filter” as required by the present claims. Mitani et al. thus fails to make up for the deficiencies in Kobayashi et al. and in the AAPA.

Johnson is applied only to show an outside air handler. As is the case for Kobayashi et al., AAPA, and Mitani et al., Johnson does not teach or suggest “one or more wafer treatment apparatuses each having a boron-less filter” as required by the present claims. Johnson thus fails to make up for the deficiencies in Kobayashi et al., the AAPA, and Mitani et al.

For at least the above reasons, claims 67-77, all of which require “one or more wafer treatment apparatuses each having a boron-less filter,” are patentable over Kobayashi et al. alone, or in any combination with the AAPA and/or Mitani et al. and/or Johnson.


Appellant respectfully submits that the references, alone or in any combination fails to teach or suggest the invention of present claims 67-77.

For all of the above-noted reasons, it is strongly contended that clear differences exist between the present invention as recited in claims 67-77 and the prior art relied upon by the Office Action.

This final rejection being in error, therefore it is respectfully requested that this Honorable Board of Patent Appeals and Interferences reverse the Examiner's decision in this case and indicate the allowability of claims 67-77.

In the event that this paper is not considered timely filed, Appellants respectfully petition for an appropriate extension of time. Any fees for such extension, together with any additional fees which may be due with respect to this paper, may be charged to Deposit Account No. 01-2300, making reference to attorney docket number 107242-00017.

Respectfully submitted,

A handwritten signature in black ink, reading "Robert K. Carpenter", with a long horizontal flourish extending to the right.

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## APPENDIX 1

### CLAIMS ON APPEAL

Claims 1-26 (Canceled)

27. (Withdrawn) A silicon wafer, characterized in that an attached boron amount on a surface of the silicon wafer is  $1 \times 10^{10}$  atoms/cm<sup>2</sup> or less.

28. (Withdrawn) A silicon wafer, characterized in that an increment of a boron concentration in a surface layer down to a depth of 0.5  $\mu\text{m}$  relative to a boron concentration in bulk silicon direct beneath the surface layer is  $1 \times 10^{15}$  atoms/cm<sup>3</sup> or less.

29. (Withdrawn) A silicon wafer, characterized in that the silicon wafer has a polycrystal silicon layer on one of major surfaces thereof and an increment of a boron concentration in an adjacent layer of a thickness of 1  $\mu\text{m}$  adjacent to and including an interface between the polycrystal silicon layer and a single crystal silicon layer relative to a boron concentration in silicon in external contact with the adjacent layer is  $1 \times 10^{15}$  atoms/cm<sup>3</sup> or less.

30. (Withdrawn) A silicon epitaxial wafer, characterized in that the silicon epitaxial wafer has a structure in which a polycrystal silicon layer is provided on a back surface of a single crystal silicon substrate and an increment of a boron concentration in an adjacent layer of a thickness of 1  $\mu\text{m}$  adjacent to and including an interface between

single crystal silicon of the substrate and the polycrystal silicon layer relative to a boron concentration in silicon of the substrate in external contact with the adjacent layer is  $1 \times 10^{15}$  atoms/cm<sup>3</sup> or less.

31. (Withdrawn) A silicon wafer, characterized in that the silicon wafer has a structure in which a CVD silicon oxide film is provided on one of major surfaces thereof and an increment of a boron concentration in a single crystal silicon adjacent layer of a thickness within 0.5  $\mu\text{m}$  of an interface between the CVD silicon oxide film and the silicon wafer relative to a boron concentration in bulk silicon in contact with the adjacent layer is  $1 \times 10^{15}$  atoms/cm<sup>3</sup> or less.

32. (Withdrawn) A silicon epitaxial wafer, characterized in that the silicon epitaxial wafer has a structure in which a CVD silicon oxide film is provided on a back surface of a single crystal silicon substrate and an increment of a boron concentration in a substrate single crystal silicon adjacent layer of a thickness within 0.5  $\mu\text{m}$  of an interface between the CVD silicon oxide film and the substrate relative to a boron concentration in silicon of the substrate in contact with the adjacent layer is  $1 \times 10^{15}$  atoms/cm<sup>3</sup> or less.

33. (Withdrawn) A silicon wafer according to claim 29, characterized in that the polycrystal layer a boron concentration in at least part of which is  $5 \times 10^{14}$  atoms/cm<sup>3</sup> or less is provided on a back surface of the silicon wafer.

34. (Withdrawn) A silicon epitaxial wafer according to claim 30, characterized in that the polycrystal layer a boron concentration in at least part of which is  $5 \times 10^{14}$  atoms/cm<sup>3</sup> or less is provided on a back surface of the single crystal silicon substrate.

35. (Withdrawn) A silicon wafer, characterized in that the silicon wafer has a structure in which a polycrystal silicon layer is provided on one major surface of a single crystal silicon layer and a CVD silicon oxide film is further provided on the polycrystal silicon layer, and an increment of a boron concentration in a first adjacent layer of a thickness of 1  $\mu\text{m}$  adjacent to and including an interface between the polycrystal silicon layer and the single crystal silicon layer relative to a boron concentration in silicon in external contact with the first adjacent layer is  $1 \times 10^{15}$  atoms/cm<sup>3</sup> or less and an increment of a boron concentration in a polycrystal silicon adjacent layer of a thickness of 0.5  $\mu\text{m}$  adjacent to and including an interface between the CVD silicon oxide film and the polycrystal silicon layer relative to a boron concentration in polycrystal silicon in external contact with the polycrystal silicon adjacent layer is  $1 \times 10^{15}$  atoms/cm<sup>3</sup> or less.

36. (Withdrawn) A silicon epitaxial wafer, characterized in that the silicon epitaxial wafer has a structure in which a polycrystal silicon layer is provided on a back surface of a substrate and a CVD silicon oxide film is further provided on the polycrystal silicon layer, and an increment of a boron concentration in a second adjacent layer of a thickness of 1  $\mu\text{m}$  adjacent to and including an interface between the polycrystal silicon layer and a single crystal silicon layer relative to a boron concentration in silicon in external contact with the second adjacent layer is  $1 \times 10^{15}$  atoms/cm<sup>3</sup> or less and an

increment of a boron concentration in a polycrystal silicon adjacent layer of a thickness of 0.5  $\mu\text{m}$  adjacent to and including an interface between the CVD silicon oxide film and the polycrystal silicon layer relative to a boron concentration in polycrystal silicon in external contact with the polycrystal silicon adjacent layer is  $1 \times 10^{15}$  atoms/cm<sup>3</sup> or less.

37. (Withdrawn) A silicon wafer according to claim 27, characterized in that a boron concentration in the single crystal silicon bulk is  $1 \times 10^{16}$  atoms/cm<sup>3</sup> or less.

38. (Withdrawn) A silicon wafer according to claim 28, characterized in that a boron concentration in the single crystal silicon bulk is  $1 \times 10^{16}$  atoms/cm<sup>3</sup> or less.

39. (Withdrawn) A silicon wafer according to claim 29, characterized in that a boron concentration in the single crystal silicon bulk is  $1 \times 10^{16}$  atoms/cm<sup>3</sup> or less.

40. (Withdrawn) A silicon wafer according to claim 31, characterized in that a boron concentration in the single crystal silicon bulk is  $1 \times 10^{16}$  atoms/cm<sup>3</sup> or less.

41. (Withdrawn) A silicon wafer according to claim 35, characterized in that a boron concentration in the single crystal silicon bulk is  $1 \times 10^{16}$  atoms/cm<sup>3</sup> or less.

42. (Withdrawn) A silicon epitaxial wafer according to claim 30, characterized in that a boron concentration in the substrate is  $1 \times 10^{16}$  atoms/cm<sup>3</sup> or less.

43. (Withdrawn) A silicon epitaxial wafer according to claim 32, characterized in that a boron concentration in the substrate is  $1 \times 10^{16}$  atoms/cm<sup>3</sup> or less.

44. (Withdrawn) A silicon epitaxial wafer according to claim 36, characterized in that a boron concentration in the substrate is  $1 \times 10^{16}$  atoms/cm<sup>3</sup> or less.

45. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 27, the silicon wafer is subjected to handling such as treatment and storage in an atmosphere of a boron concentration of 15 ng/m<sup>3</sup> or less.

46. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 28, the silicon wafer is subjected to handling such as treatment and storage in an atmosphere of a boron concentration of 15 ng/m<sup>3</sup> or less.

47. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 29, the silicon wafer is subjected to handling such as treatment and storage in an atmosphere of a boron concentration of 15 ng/m<sup>3</sup> or less.

48. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 31, the silicon wafer is



subjected to handling such as treatment and storage in an atmosphere of a boron concentration of  $15 \text{ ng/m}^3$  or less.

49. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 35, the silicon wafer is subjected to handling such as treatment and storage in an atmosphere of a boron concentration of  $15 \text{ ng/m}^3$  or less.

50. (Withdrawn) A manufacturing process for a silicon epitaxial wafer, characterized in that in manufacture of the silicon epitaxial wafer according to claim 30, the silicon epitaxial wafer is subjected to handling such as treatment and storage in an atmosphere of a boron concentration of  $15 \text{ ng/m}^3$  or less.

51. (Withdrawn) A manufacturing process for a silicon epitaxial wafer, characterized in that in manufacture of the silicon epitaxial wafer according to claim 32, the silicon epitaxial wafer is subjected to handling such as treatment and storage in an atmosphere of a boron concentration of  $15 \text{ ng/m}^3$  or less.

52. (Withdrawn) A manufacturing process for a silicon epitaxial wafer, characterized in that in manufacture of the silicon epitaxial wafer according to claim 36, the silicon epitaxial wafer is subjected to handling such as treatment and storage in an atmosphere of a boron concentration of  $15 \text{ ng/m}^3$  or less.

53. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 29, formation of a polycrystal silicon layer is performed in an atmosphere of a boron concentration of  $15 \text{ ng/m}^3$  or less.

54. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 35, formation of a polycrystal silicon layer is performed in an atmosphere of a boron concentration of  $15 \text{ ng/m}^3$  or less.

55. (Withdrawn) A manufacturing process for a silicon epitaxial wafer, characterized in that in manufacture of the silicon epitaxial wafer according to claim 30, formation of a polycrystal silicon layer is performed in an atmosphere of a boron concentration of  $15 \text{ ng/m}^3$  or less.

56. (Withdrawn) A manufacturing process for a silicon epitaxial wafer, characterized in that in manufacture of the silicon epitaxial wafer according to claim 36, formation of a polycrystal silicon layer is performed in an atmosphere of a boron concentration of  $15 \text{ ng/m}^3$  or less.

57. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 31, formation of a CVD silicon oxide film is performed in an atmosphere of a boron concentration of  $15 \text{ ng/m}^3$  or less.

58. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 35, formation of a CVD silicon oxide film is performed in an atmosphere of a boron concentration of  $15 \text{ ng/m}^3$  or less.

59. (Withdrawn) A manufacturing process for a silicon epitaxial wafer, characterized in that in manufacture of the silicon epitaxial wafer according to claim 30, formation of a CVD silicon oxide film is performed in an atmosphere of a boron concentration of  $15 \text{ ng/m}^3$  or less.

60. (Withdrawn) A manufacturing process for a silicon epitaxial wafer, characterized in that in manufacture of the silicon epitaxial wafer according to claim 36, formation of a CVD silicon oxide film is performed in an atmosphere of a boron concentration of  $15 \text{ ng/m}^3$  or less.

61. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 29, a polycrystal layer is formed on a surface on which an attached boron amount is suppressed to  $1 \times 10^{10}$  atoms/cm<sup>2</sup> or less.

62. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 35, a polycrystal layer is

formed on a surface on which an attached boron amount is suppressed to  $1 \times 10^{10}$  atoms/cm<sup>2</sup> or less.

63. (Withdrawn) A manufacturing process for a silicon epitaxial wafer, characterized in that the manufacture of the silicon epitaxial wafer according to claim 30, a polycrystal layer is formed on a surface on which an attached boron amount is suppressed to  $1 \times 10^{10}$  atoms/cm<sup>2</sup> or less.

64. (Withdrawn) A manufacturing process for a silicon epitaxial wafer, characterized in that the manufacture of the silicon epitaxial wafer according to claim 36, a polycrystal layer is formed on a surface on which an attached boron amount is suppressed to  $1 \times 10^{10}$  atoms/cm<sup>2</sup> or less.

65. (Withdrawn) An atmosphere control apparatus, characterized in that the atmosphere control apparatus controls a boron concentration in an atmosphere to be 15 ng/m<sup>3</sup> or less.

66. (Withdrawn) A clean room, characterized in that a boron concentration in an atmosphere of the clean room is 15 ng/m<sup>3</sup> or less.

67. (Original) Clean room air conditioning facilities comprising: an air conditioner having a boron-less filter and a boron adsorbing filter; and one or more of wafer treatment apparatuses each having a boron-less filter, wherein an atmosphere

gas is recycled between the air conditioner, the clean room and the wafer treatment apparatuses.

68. (Previously Presented) Clean room air conditioning facilities according to claim 67, further including an outdoor air cleaner having a boron-less filter and a boron adsorbing filter.

69. (Original) Clean room air conditioning facilities according to claim 67, in which an internal pressure of a wafer treatment apparatus is adjusted to be higher than a clean room internal pressure and the clean room internal pressure is adjusted to be higher than an external pressure.

70. (Original) A manufacturing process for a wafer, characterized in that manufacture of the wafer is performed using clean room air conditioning facilities according to claim 67, the wafer being characterized in that an attached boron amount on a surface of the silicon wafer is  $1 \times 10^{10}$  atoms/cm<sup>2</sup> or less.

71. (Original) A manufacturing process for a wafer, characterized in that manufacture of the wafer is performed using clean room air conditioning facilities according to claim 67, the wafer being characterized in that an increment of a boron concentration in a surface layer down to a depth of 0.5  $\mu\text{m}$  relative to a boron concentration in bulk silicon direct beneath the surface layer is  $1 \times 10^{15}$  atoms/cm<sup>3</sup> or less.

72. (Original) A manufacturing process for a wafer, characterized in that manufacture of the wafer is performed using clean room air conditioning facilities according to claim 67, the wafer being characterized in that the silicon wafer has a polycrystal silicon layer on one of major surfaces thereof and an increment of a boron concentration in an adjacent layer of a thickness of 1  $\mu\text{m}$  adjacent to and including an interface between the polycrystal silicon layer and a single crystal silicon layer relative to a boron concentration in silicon in external contact with the adjacent layer is  $1 \times 10^{15}$  atoms/cm<sup>3</sup> or less.

73. (Original) A manufacturing process for a wafer, characterized in that manufacture of the wafer is performed using clean room air conditioning facilities according to claim 67, the wafer being characterized in that the silicon epitaxial wafer has a structure in which a polycrystal silicon layer is provided on a back surface of a single crystal silicon substrate and an increment of a boron concentration in an adjacent layer of a thickness of 1  $\mu\text{m}$  adjacent to and including an interface between single crystal silicon of the substrate and the polycrystal silicon layer relative to a boron concentration in silicon of the substrate in external contact with the adjacent layer is  $1 \times 10^{15}$  atoms/cm<sup>3</sup> or less.

74. (Original) A manufacturing process for a wafer, characterized in that manufacture of the wafer is performed using clean room air conditioning facilities according to claim 67, the wafer being characterized in that the silicon wafer has a

structure in which a CVD silicon oxide film is provided on one of major surfaces thereof and an increment of a boron concentration in a single crystal silicon adjacent layer of a thickness within 0.5  $\mu\text{m}$  of an interface between the CVD silicon oxide film and the silicon wafer relative to a boron concentration in bulk silicon in contact with the adjacent layer is  $1 \times 10^{15}$  atoms/ $\text{cm}^3$  or less.

75. (Original) A manufacturing process for a wafer, characterized in that manufacture of the wafer is performed using clean room air conditioning facilities according to claim 67, the wafer being characterized in that the silicon epitaxial wafer has a structure in which a CVD silicon oxide film is provided on a back surface of a single crystal silicon substrate and an increment of a boron concentration in a substrate single crystal silicon adjacent layer of a thickness within 0.5  $\mu\text{m}$  of an interface between the CVD silicon oxide film and the substrate relative to a boron concentration in silicon of the substrate in contact with the adjacent layer is  $1 \times 10^{15}$  atoms/ $\text{cm}^3$  or less.

76. (Original) A manufacturing process for a wafer, characterized in that manufacture of the wafer is performed using clean room air conditioning facilities according to claim 67, the wafer being characterized in that the silicon wafer has a structure in which a polycrystal silicon layer is provided on one major surface of a single crystal silicon layer and a CVD silicon oxide film is further provided on the polycrystal silicon layer, and an increment of a boron concentration in a first adjacent layer of a thickness of 1  $\mu\text{m}$  adjacent to and including an interface between the polycrystal silicon layer and the single crystal silicon layer relative to a boron concentration in silicon in

external contact with the first adjacent layer is  $1 \times 10^{15}$  atoms/cm<sup>3</sup> or less and an increment of a boron concentration in a polycrystal silicon adjacent layer of a thickness of 0.5  $\mu\text{m}$  adjacent to and including an interface between the CVD silicon oxide film and the polycrystal silicon layer relative to a boron concentration in polycrystal silicon in external contact with the polycrystal silicon adjacent layer is  $1 \times 10^{15}$  atoms/cm<sup>3</sup> or less.

77. (Original) A manufacturing process for a wafer, characterized in that manufacture of the wafer is performed using clean room air conditioning facilities according to claim 67, the wafer being characterized in that the silicon epitaxial wafer has a structure in which a polycrystal silicon layer is provided on a back surface of a substrate and a CVD silicon oxide film is further provided on the polycrystal silicon layer, and an increment of a boron concentration in a second adjacent layer of a thickness of 1  $\mu\text{m}$  adjacent to and including an interface between the polycrystal silicon layer and a single crystal silicon layer relative to a boron concentration in silicon in external contact with the second adjacent layer is  $1 \times 10^{15}$  atoms/cm<sup>3</sup> or less and an increment of a boron concentration in a polycrystal silicon adjacent layer of a thickness of 0.5  $\mu\text{m}$  adjacent to and including an interface between the CVD silicon oxide film and the polycrystal silicon layer relative to a boron concentration in polycrystal silicon in external contact with the polycrystal silicon adjacent layer is  $1 \times 10^{15}$  atoms/cm<sup>3</sup> or less.